# Optical model analyses of elastic scattering, fusion, and breakup reaction induced by loosely bound nuclei

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Within the framework of an extended optical model, simultaneous $\chi^2$ analyses are performed for elastic scattering and fusion cross section data for $^{6}$Li+$^{208}$Pb [1, 2] and $^{9}$Be+$^{209}$Bi [3, 4] systems, both involving loosely bound projectiles, at near-Coulomb-barrier energies to determine the polarization potential decomposed into direct reaction (DR) and fusion parts. We show that both DR and fusion potentials extracted from $\chi^2$ analyses satisfy separately the dispersion relation and that the threshold anomaly appears in the fusion part. The DR potential turns out to be rather a smooth function of the incident energy, and has the magnitudes at the strong absorption radius much larger than those of the fusion potential, explaining why the threshold anomaly is not seen in the optical potential deduced from the fit to the elastic scattering data without such a decomposition. Using the extracted DR potential, we examine the effects of breakup on fusion cross sections, $\sigma_F$. The observed suppression of $\sigma_F$ in the above barrier region can be explained in terms of the flux loss due to breakup. However, the observed enhancement of $\sigma_F$ in the subbarrier region can not be understood in terms of the breakup effect. Rather, the enhancement can be related to the $Q$-value of the neutron(s) transfer of the systems, supporting the ideas of Stelson *et al.* [5] that the subbarrier fusion starts to occur when the colliding ions approach each other at a distance where the barrier against the flow of the valence neutron(s) disappears and thus the flow can take place freely.

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